

Hiroyuki KASHIWADANI* & Syo KUROKAWA*: Notes on Japanese
and Formosan species of *Anthracothecium* (2)**

柏谷博之*・黒川 遼*: 日本および台湾産の
ニキビゴケ属について (2)
(Pl. XII)

4. *Anthracothecium majus* (Zahlbr.) Kashiw. & Kurok., comb. nov.

Anthracothecium angulatum var. *majus* Zahlbr. in Fedde, Repert. 31: 203 (1933). Type collection. Formosa, Mt. Alisan, Y. Asahina F-326—holotype in W, isotype in TNS.

Thallus epi- and endophloeodes, grayish brown or yellowish brown, smooth, forming a colony 10-20 cm in diameter. Thallus rather thick; outer chondroid layer very pale brown, 60-90 μ thick; gonidial layer continuous, 15-20 μ thick, gonidia belonging to *Trentepohlia*, ca. $3 \times 5 \mu$ in size; medulla white, medullary hyphae penetrating into the tissue of substratum up to 500 μ in depth. Ascocarp prominent, solitary, denuded, black, 1.5-2.8 mm in diameter; ostiole yellowish brown, terminal. Ascocarp immersed at the lower half; involucrellum developed, thick, covering the exciple excepting at the bottom, 250-300 μ thick near the top, becoming thicker towards the base or extending laterally (up to 1000 μ thick); proper exciple thin, containing no crystal, 10-15 μ thick; nucleus conical or subglobose, flattened at the base, sometimes divided into two or more cavities, 870-1120 μ in diameter, 750-1000 μ in height; hymenium J+yellowish blue or blue; paraphyses rarely branched, rarely anastomosed; asci bitunicate, 8-spored; spores uniseriate, dark brown, muriform, transversely 6-8-septate, $24-30 \times 70-90 \mu$, each transverse section 5-8-locellate. Only little acetone residue.

In 1933, Zahlbruckner described *A. angulatum* and its variety, var. *majus*, from Formosa. However, the exciple of *A. angulatum* (a synonym of *A. oculatum*, see below) is of the *Pyrenula nitida* type, whereas that of var. *majus* of the *Pyrenula japonica* type. Thus, *A. majus* is considered herewith as a distinct species. It is known only from Formosa at present.

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Continued from Journ. Jap. Bot. 56: 303-312 (1981).

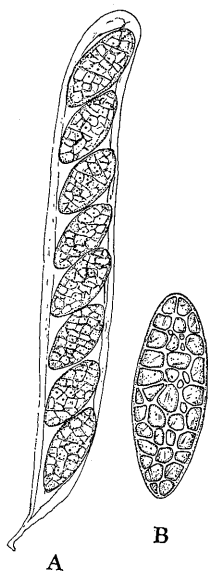


Fig. 5. *Anthracothecium majus* (Zahlbr.) Kashiw. & Kurok.
A: Ascus, and spores, $\times 250$.
B: Spore, $\times 500$.

Anthracothecium majus is characterized by the large solitary ascocarp composed of thick involucrellum (250–1000 μ thick) and the exciple of the *Pyrenula japonica* type, the hymenium showing yellowish blue to blue reaction with J, the 8-spored asci, and the spores of 70–90 μ long. Spores of most species of *Anthracothecium* are rather regularly septate in transverse direction. In contrast, transverse septation of spores is more or less irregular in the present species. Thus, locelli are more or less irregularly arranged in transverse direction in mature spores.

Specimens examined. Formosa. Prov. Hsinchu: Mt. Kakuban, M. Ogata (Herb. Y. Asahina F-327, TNS). Prov. Changhua: Rengechi, Y. Asahina F-329 (TNS).

5. *Anthracothecium manipurens* Müll. Arg., Journ. Linn. Soc. London, Bot. 29: 231 (1892). Type collection. India. Manipur, G. Watt s. n. —holotype in G.

Bottaria columellata Vain., Ann. Acad. Sci. Fenn., ser. A. 15: 325 (1921) — *Anthracothecium columellatum* (Vain.) Zahlbr., Cat. Lich. Univ. 8: 121 (1922). Type collection. The Philippines. Palawan, E. Fénix 15635 (hb. Vainio 30953)—lectotype in TUR.

Thallus epi- and endophloeodes, yellowish brown or yellowish olive, smooth, forming a colony 5–20 cm in diameter. Thallus rather thick, outer chondroid layer 40–50 μ thick; gonidial layer continuous 13–25 μ thick, gonidia belonging to *Trentepohlia*, ca. $3 \times 6 \mu$ in size; medulla white, medullary hyphae penetrating into the tissue of substratum up to 600 μ in depth. Ascocarp very prominent, hemiglobose, solitary, grayish black to black, denuded or rarely covered with thallus, 2–3.5 mm in diameter; ostiole brownish black, terminal. Ascocarp immersed at the lower half; involucrellum well developed, black, thick, covering the exciple excepting at the bottom of ascocarp, 250–300 μ near the top, becoming thicker towards the base (up to 900 μ thick); proper exciple very thin, containing

no crystal, 10-15 μ thick; nucleus conical or subglobose, 900-1100 μ in diameter, 1000-1300 μ in height; hymenium J+yellowish blue or blue; paraphyses very rarely branched, rarely anastomosed; asci bitunicate, (3-)4-6(-8)-spored; spores biseriate, dark brown, muriform, transversely 13-18-septate, (25-)30-35 (-40) \times (90-)100-130(-160) μ , each transverse section 6-8-locellate. Only little acetone residue.

Anthracotheций manipurensе is apparently closely related to *A. majus*, because both species have very similar ascocarps composed of well-developed thick involucrellum and rather thin exciple, hymenium showing yellowish blue or blue reaction with J, and spores with locelli more or less irregularly arranged in transverse direction.

However, it can be distinguished from the latter species by the 2-4-spored asci producing larger spores (94-130 μ long) rather than the 8-spored asci producing smaller spores (less than 80 μ long). In addition, spores are biseriate in *A. manipurensе*, whereas they are uniseriate in *A. majus*.

Specimens examined. Japan. Honshu. Prov. Kii: Akitsugawa-mura, Nishimuro-gun, N. Ui 752 (TNS). Shikoku. Prov. Iyo: Mt. Nametoko, Kitauwagun, M. Ogata s.n. (TNS). Kyushu. Prov. Hyuga: Wariwa-dani, Sakatani-mura, Minaminaka-gun, S. Kurokawa 550037 (TNS). Ryukyu Islands. Ishigaki Island: Mt. Maedaka-dake, S. Kurokawa 73093 (TNS).

6. *Anthracotheций oculatum* Müll. Arg., Nuov. Giorn. Bot. Ital. 23: 404 (1891). Type collection. Australia. Brisbane, F.M. Bailey 509—holotype in G.

Anthracotheций angulatum Zahlbr. in Fedde, Repert. 31: 202 (1933). Type collection. Formosa. Mt. Alisan, Y. Asahina 298—holotype in G, isotype in TNS.

Thallus epi- and endophloeodes, straw-yellow or grayish brown, smooth or sometimes rimose, broadly expanded, 5-20 cm in diameter. Thallus rather thick, outer chondroid layer hyaline, 50-70 μ thick; gonidial layer continuous

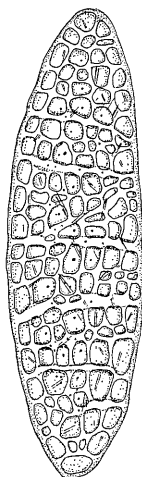


Fig. 6. Mature spore of *Anthracotheций manipurensе* Müll. Arg., $\times 500$.

or discontinuous, 10-20 μ thick, gonidia belonging to *Trentepohlia*, 4-5 \times 6-8 μ in size; medulla white, medullary hyphae penetrating into the tissue of substratum up to 300 μ in depth. Ascocarp prominent, hemiglobose, solitary or 2-4-confluent, straw-yellow, grayish black only near the ostioles, covered with thallus up to the margin of ostioles or narrowly denuded near the top, 1-1.5 mm in diameter; ostioles light-brown, terminal. Ascocarp immersed at the lower half; involucrellum blackish brown, well-developed, entirely covering the exciple excepting at the bottom of ascocarp, 90-110 μ thick; exciple entire, containing crystals of calcium oxalate, 30-60 μ thick at lateral sides, 15-20 μ at base; nucleus subglobose or somewhat flattened at base, 650-900 μ in diameter, 700-900 μ in height, J+reddish brown; paraphyses rarely branched, rarely anastomosed; asci oblong, bitunicate, 4-6(-8)-spored in juvenile stages, 3-4-spored in mature stages; spores oblong, dark brown, muriform, transversely 6-10-septate, 20-30 \times (80-)90-110(-135) μ , each transverse section 6-8-locellate. Only little acetone residue.

Since *Anthracothecium oculatum* was described by Müller Arg. from Australia, it has never been reported in the literature. In Japan, Asahina (1931) recognized it to be a separate species, giving a Japanese common name "Izu-nikibigoke". Asahina's Izunikibigoke is quite identical with the type specimen of *A. oculatum*, because it has thick exciple (the *Pyrenula nitida* type) covered with well-developed involucrellum, muriform brown spores of 90-120 μ in size, and the hymenium which is J+constantly reddish brown.

This species may be confused with *A. asahinae*, because they have similar exciples covered with involucrellum. However, it has larger spores with 6-8 locelli in each transverse section, whereas the spores are small (37-52 μ long) and have 2-3 locelli in each transverse section in *A. asahinae*. In addition, the hymenium is J+constantly reddish brown in this species, though it is J+ faintly blue or blue in *A. asahinae*.

This species, at present, has been collected only in Japan, Formosa, and Australia, but is probably found in other parts of the Pacific Coast. It is rather common in lowland of central to southern Honshu, where it grows on trunks of broad-leaved trees such as *Acer*, *Camelia*, and *Eurya*.

Specimens examined. Japan. Honshu. Prov. Musashi: Sakamoto, Hanno-city, on bark of *Camelia japonica*, elevation about 280 m, H. Kashiwadani 14571 (TNS); Mt. Takao, Y. Asahina s.n. (TNS). Izu Islands. Mikura-jima Island,

on bark of *Camelia japonica*, Y. Doi s.n. (TNS). Prov. Izu: Yugashima, S. Kurokawa 57011 (TNS); Kadoike, Mishima, Y. Asahina s.n. (Mat. Lich. Fl. Jap. 25, TNS). Prov. Suruga: Morinokoshi, Gotemba, M. Togashi (Herb. Y. Asahina 549007, 549008, TNS); Vicinity of Gotemba, S. Kurokawa 540032, 540041 (TNS). Prov. Mikawa: Mt. Horaiji, S. Kurokawa 56021 (TNS). Prov. Izumo: Kiyomizu Temple, A. Yasuda 102 (TNS). Shikoku. Prov. Tosa: Befukyo Gorge, Monobe-mura, Kami-gun, H. Kashiwadani, 16035 (TNS); Takeyashiki, Aki-gun, F. Fujikawa s.n. (TNS); Irino, Ohkata-cho, Hata-gun, S. Kurokawa 55021 (TNS). Kyushu. Prov. Hyuga: Enokibara, Minaminaka-gun, S. Kurokawa 550092 (TNS).

7. ***Anthracothecium pachycheilum*** (Tuck.) Zahlbr., Cat. Lich. Univ. 1: 465 (1922).

Pyrenula pachycheila Tuck., Gen. Lich. 274 (1872). Type collection. U.S. A. Santee Canal, South Carolina, H. W. Ravenel 89—lectotype in FH.

Anthracothecium fraternale Zahlbr., Symb. Sinic. 3: 27 (1930). Type collection. Formosa. Gu-shan, Fudschon, on bark of tree, elevation 500-600 m, H. H. Chung 445b—holotype in W.

Thallus epi- and endophloeodes, yellowish brown or greenish brown, smooth, forming a colony of 5-10 cm in diameter. Thallus rather thin, outer chondroid layer very pale brown, 12-25 μ thick; gonidial layer discontinuous or continuous lying under the bark cells of substratum, 25-30 μ thick, gonidia belonging to *Trentepohlia*, 2.5 \times 5 μ in size; medulla white, medullary hyphae penetrating into the tissue of the substratum 150-200 μ in depth. Ascocarp more or less prominent, hemi-globose, 3-5-confluent or very rarely solitary, thickly covered with the thallus up to the margins of ostioles, 0.5-0.9 mm in diameter; ostiole blackish brown, terminal. Ascocarp immersed at the lower half; involucrellum poorly developed or if present it is restricted to the narrow regions around the ostiole; exciple subglobose, thick, containing small amount of crystals of calcium oxalate, 80-100 μ thick near the top, 50-60 μ thick at lateral sides, and 20-30 μ thick at base, 500-700 μ in diameter, 500-670 μ in height; J+reddish brown; paraphyses very rarely branched, rarely anastomosed; asci oblong, bitunicate, 8-spored; spores biseriate, oblong to ellipsoid, brown to dark brown, transversely 6-7-septate, 18-27 (-32) \times (45-) 50-67 (-72) μ , each transverse section 2-4-locellate. Acetone residue contains unknown substances recrystallized in GAW.

Anthracothecium pachycheilum is characterized by having thick exciple

containing small amount of crystals, poorly developed involucrellum, and small spores of 50-67 μ long, by showing J+reddish brown reaction in hymenium, and by producing unknown substances.

This species is very uniform in morphological and chemical characters. When the acetone residue of this species is recrystallized in GAW, it yields colorless long needles (Fig. 1B) and colorless warty aggregates (Fig. 1C). Although these two crystals are constantly observed in most specimens, the long needles were not observed in two specimens (H.H. Chung 445b from Formosa; Y. Asahina s.n. from Tanabe, Japan), probably because of the low concentration.

Tuckerman (1872) described *Pyrenula pachycheila* on the basis of four specimens collected from different localities in North America. All the syntype specimens are identical each other both in morphological and chemical features. Among the syntype specimens, specimen collected by H.W. Ravenel at Sante Canal, South Carolina is designated here as the lectotype.

When Malme (1972) studied South American species of *Anthracotheceum*, he treated the present species as a synonym of *A. leucostomum* (Ach.) Malme. However, the unknown substances mentioned above were never demonstrated in the holotype specimen of *Pyrenula leucostoma* Ach. (Type. India Occidentalis, H.Ach. 837 in H).

This species seems to be widely distributed in temperate and tropical zones in the world, having been collected in Japan, Formosa, New Caledonia, and North America. In Japan, it is common on trunks of *Camelia japonica* and *Daphniphyllum teijsmanii*.

Specimens examined. Japan. Honshu. Izu Islands. Hachijo Island: Mt. Hachijo-Fuji, elevation about 650 m, H. Kashiwadani 13589 (TNS); Nakanogo, elevation about 10 m, H. Kashiwadani 13646 (TNS); Okasato, M. Togashi s.n. (TNS); Mt. Mihara, elevation about 150 m, H. Kashiwadani 13636, 13642b (TNS). Prov. Kii: Inazumi-jima Island, Susami-cho, Nishimuro-gun, H. Kashiwadani 14613b (TNS); Wabuka, Susami-cho, Nishimuro-gun, H. Kashiwadani 14668 (TNS); Cape Esu-zaki, Nishimuro-gun, on bark of *Daphniphyllum teijsmanii*, H. Kashiwadani 14654 (TNS); Tabane, Y. Asahina s.n. (TNS). Shikoku. Prov. Tosa: Cape Ashizuri, S. Kurokawa 550192, 550197 (TNS); Syoryuji Temple, Tosa-city, H. Kashiwadani 14950, 14951 (TNS); Irino, Ohkata-cho, Hata-gun, S. Kurokawa 550222, 550223 (TNS); Ida, Shimotagawa-mura, Hata-gun, S. Kurokawa 550244 (TNS). Kyushu. Prov. Hyuga: Nakaura, Nishibenbun, Nichinan, S.

Kurokawa 550081, 550084 (TNS). No detail locality, C. Wright (Hb-Nyl. p. m. 7554, H). U. S. A. South Carolina: Santee Canal, H. W. Ravenel 494 (syntype in FH); H. W. Ravenel & Curtis s. n., pr. p. (FH). Louisiana: no precise locality, Dr. Hale s. n., pr. p. (syntype in FH). Alabama: Brooklyn, W. Beaumont s. n. (syntype in FH). Texas: Houston, E. Hall s. n., pr. p. (FH); Harris Co., H. W. Ravenel 11, 70 (syntypes in FH).

Exsiccata examined. A. Vězda: Lich. Sel. Exs. 1627 (TNS), from U. S. A., distributed as *Anthracotheceum leucostomum*.

8. *Anthracotheceum vermicularis* Kashiw. & Kurok., sp. nov.

Thallus epi- et endophloeodes, crustaceus, fulvescens vel olivaceus, laevis, subnitidus, usque ad 20 cm diametro. Thallus crassiusculus; stratum corticale chondroideum, 60-90 μ crassum; stratum gonidiale continuum vel subcontinuum, 25-30 μ crassum, gonidia ad *Trentepohliam* pertinentia, ca. $2 \times 5 \mu$; medulla alba; hyphae medullosae inter cellulas substrati prorumpentens usque ad 600 μ in profunditate. Ascocarpus prominens, hemiglobosus, solitarius, niger, nudatus vel thallo tenui tectus, 1-1.5 mm diametro, ostiolo fusco, terminali. Ascocarpus protrusus vel semi-immersus; involucrellum excipulum omnino tegens, fusconigrum, 150-200 μ crassum ad apicem, 10-20 μ crassum prope basim; excipulum proprium integrum, calicium oxalcum continens, 30-50 μ crassum ad apicem, 5-10 μ crassum ad basim; nucleus subglobosus, 600-850 μ crassum ad basim; nucleus subglobosus, 600-850 μ latus, 700-800 μ altus; hymenium hyalinum, J+ caeruleus; paraphyses simplices vel paucis ramosae, raro anastomosantes; asci cylindrici, bitunicati, 2(-3)-spori; sporae fuscae, oblongae vel vermiculares, transversim 11-16 loculatae, loculis 12-18-locellatis, 30-47(-60) \times (105-) 135-220(-250) μ . Only little acetone residue.

Type collection. Japan. Prov. Tosa: Irino, Ohkata-cho, Hatagun, on bark of *Daphniphyllum teijsmanni*, S. Kurokawa 550243 holotype in TNS.

2. *Anthracotheceum vermicularis* is charac-

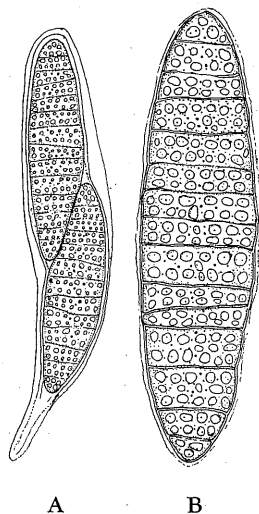


Fig. 7. *Anthracotheceum vermicularis* Kashiw. & Kurok.
A: Ascus and spores, $\times 250$.
B: Spore, $\times 500$.

terized by the thick involucrellum, the exciple of the *Pyrenula nitida* type, the J+blue reaction in hymenium, 2-spored asci, and the large spores of ca. 135–220 μ long.

Anthracothecium vermicularis may be confused with *A. oculatum*, because both species have similar ascocarps with thick involucrellum and exciples of the *Pyrenula nitida* type. However, it can be distinguished from the latter species by the 2-spored asci and the large spores of more than 130 μ in length. In addition, the hymenium shows J+blue reaction in *A. vermicularis*, whereas it shows J+reddish brown in *A. oculatum*. This species also resembles *A. variolosum*, a species widely distributed in tropical regions, which differs in having J+reddish brown hymenium and 1-spored asci.

Specimens examined. Japan. Izu Islands. Kohzu-shima Island: Mt. Tenjo, on bark of *Camelia japonica*, elevation about 270 m., H. Kashiwadani 14201 (TNS); the same locality, on bark of *Shiia* sp., elevation about 200 m., H. Kashiwadani 14295 (TNS). Shikoku. Prov. Awa: Mt. Tairyuji, Naka-gun, M. Togashi s. n. (TNS).

Literature cited

- Asahina, Y. 1931. Materials for a lichen flora of Japan. I. 94 pp., 23 pls. The Saito Gratitude Foundation, Sendai.
- Janex-Favre, M. C. 1970. Recherches sur l'ontogénie, l'organisation et les asques de quelques Pyrénolichens. Rev. Bryol. Lich. 37: 421–650.
- Huneck, S. & G. Follmann. 1970. Mitteilungen über Flechteninhaltsstoffe LXXIX. Über das Auftreten spezifischer Flechtenstoffe bei pyrenocarpes Ascolichenen. Zeitschr. Naturforsch. 25b: 759.
- Kurokawa, S. 1955. Some pyrenocarpous lichens from Chichibu (in Japanese). Bull. Chichibu Mus. Nat. Hist. 6: 38–43.
- 1971. Lichens of the Hidaka Mountains, Hokkaido. Mem. Nat. Sci. Mus. Tokyo 4: 59–70.
- Malme, G. O. 1929. Pyrenulae et Anthracothecia herbarii Regnelliani. Ark. Bot. 22A: 1–40.
- Müller Arg., 1891. Lichenes Miyoshiani in Japonica a cl. Miyoshi lecti et a cl. Professore Yatabe communicati. Nuov. Giorn. Bot. Ital. 23: 120–131.
- Tuckerman, E. 1882. A synopsis of the North American lichens 2: 1–281.
- Vainio, E. A., 1918. Lichenes ab A. Yasuda in Japonia collecti. Bot. Mag. Tokyo 32: 154–163.
- 1921. Lichenes ab A. Yasuda in Japonica collecti (Continuatio I). Bot. Mag. Tokyo 35: 63–79.
- Zahlbruckner, A. 1933. Flechten der Insel Formosa. in Fedde, Repert. 31: 194–224.

Explanation of plate XII

- 1: *Anthracothecium majus* (Zahlbr.) Kashiw. et Kurok. Holotype, $\times 1.7$.
- 2: *Anthracothecium manipurense* Müll. Arg. Holotype, $\times 1.7$
- 3: *Anthracothecium oculatum* Müll. Arg. Holotype, $\times 1.7$.
- 4: *Anthracothecium pachycheilum* (Tuck.) Zahlbr. Lectotype, $\times 1.7$.
- 5: *Anthracothecium vermicularis* Kashiw. et Kurok. Holotype, $\times 1.7$.
- 6: Spore of *Anthracothecium japonicum*, $\times 600$.
- 7: Spores of *Anthracothecium oculatum*, $\times 600$.

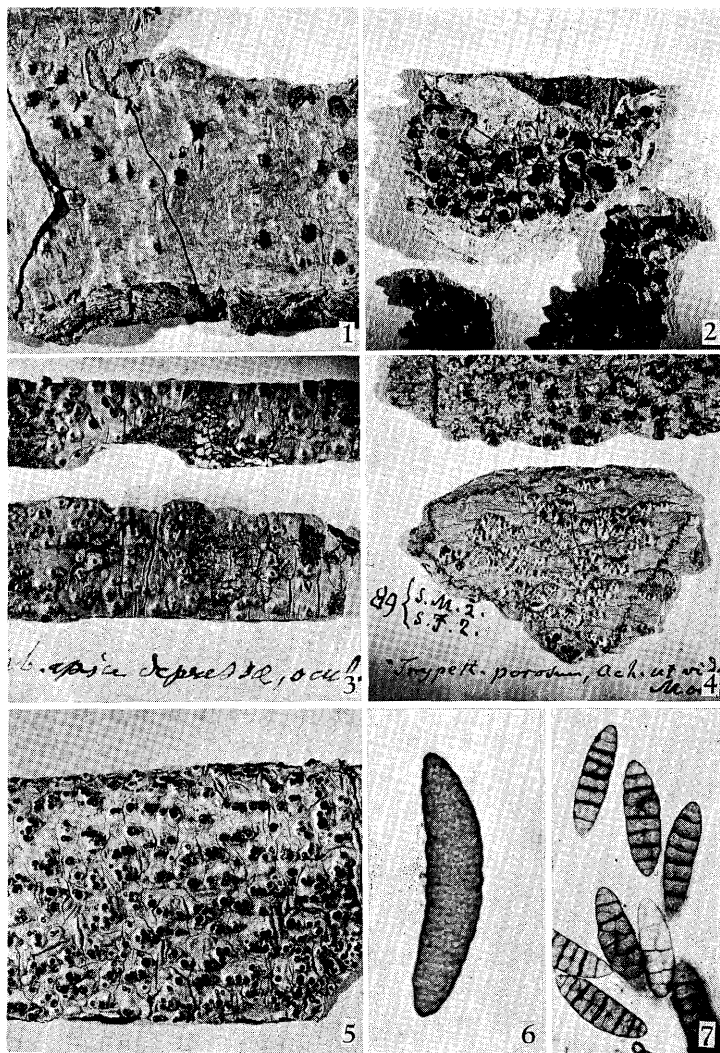
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ニキビゴケ属 *Anthracothecium* はサネゴケ科 Pyrenulaceae に属する樹皮上生の固着地衣類で主として熱帯から亜熱帯に分布し、約 95 種が世界各地から報告されている。本属の地衣類は外形的にはクロミダイダイゴケ属 *Melanotheca*, ホシミゴケ属 *Parmentaria*, モツレサネゴケ属 *Pseudopyrenula*, サネゴケ属 *Pyrenula* 等に酷似しているが子嚢果は頂部に孔口を生じ多室で褐色の胞子を持つ点で区別される。

日本及び台湾からはこれまでに 4 種 1 変種が報告されているが本属の地衣については十分に理解されていない。この論文では本地域から次の 8 種類を報告した: *Anthracothecium asahinae*, *A. japonicum*, *A. laevigatum*, *A. majus*, *A. manipurense*, *A. oculatum*, *A. pachycheilum*, *A. vermicularis*. このうち, *A. asahinae*, *A. japonicum*, *A. vermicularis* は新種であり, *A. majus* (Zahlbr.) Kashiw. & Kurok. は新組合せである。Vainio が報告した *A. olivaceocinereum* は原記載では褐色多室の胞子を有すると書かれているのに反して、正副基準標本共に胞子はサネゴケ属にみられる褐色 4 室のものしか確認できなかったため、本研究ではその存在を確認できなかった。また *A. variolosum* は日本産地衣フロラから除外された。

ニキビゴケ属の子嚢果はすべて果殻 proper exciple と被殻 involucrellum から構成されているが果殻の構造からみると次の 2 型が認められる。即ち厚さ 20μ 以下で内部に結晶を含まない型 (*Pyrenula japonicum*-Type) と厚さ $50\sim 100\mu$ で中に尿酸カルシウムの結晶を含む型 (*Pyrenula nitida*-Type) である。両者は結晶の有無で容易に区別できる。今回報告されたニキビゴケ属地衣のうち *A. japonicum*, *A. laevigatum*, *A. majus*, *A. manipurense* の 4 種は *Pyrenula japonica* 型の果殻を持ち、残り 4 種は *Pyrenula nitida* 型の果殻を持つ。

被子器状の子嚢果を有する地衣類のうち、*Pyrenula* にはやはりこの 2 型が認められる (Kurokawa, 1971) が、*Melanotheca*, *Pseudopyrenula*, *Trypethelium* 等の果殻はすべて *Pyrenula japonica* 型である。



H. KASHIWADANI & S. KUROKAWA: Japanese
and Formosan *Anthracothecium*